(19) Europäische Patentamt
European Patent Office
Office européen d s brevets

(11) Publication number : 0 683 598 A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number : 95303284.4

(22) Date of filing : 17.05.95

(51) Int. Cl.[6] : H04N 1/407

(30) Priority : 18.05.94 JP 103978/94

(43) Date of publication of application : 22.11.95 Bulletin 95/47

(84) Designated Contracting States : DE FR GB IT NL

(71) Applicant : KONICA CORPORATION
26-2, Nishishinjuku 1-chome,
Shinjuku-ku
Tokyo 160 (JP)

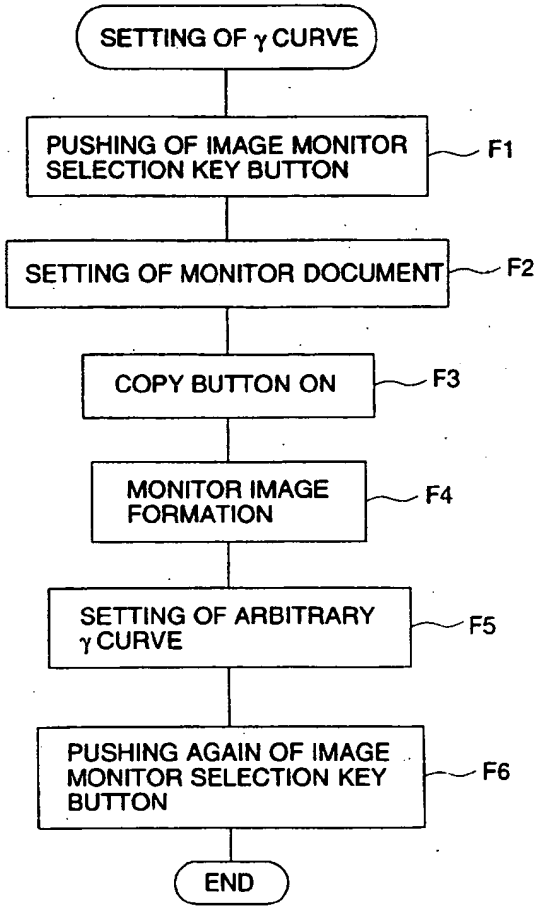
(72) Inventor : Yokobori, Jun
c/o Konica Corporation,
2970 Ishikawa-cho
Hachioji-shi, Tokyo (JP)
Inventor : Soma, Utami
c/o Konica Corporation,
2970 Ishikawa-cho
Hachioji-shi, Tokyo (JP)

(74) Representative : Wood, Anthony Charles et al
Urquhart-Dykes & Lord
91 Wimpole Street
London W1M 8AH (GB)

(54) Image forming apparatus.

(57) An image forming apparatus includes an image reading unit to optically read a document image and to convert the read document image into an electrical signal, a correction member to correct the electric signal through a γ-curve and to generate a recording signal in which the corrector has plural γ-curve characteristics data corresponding to plural γ-curves, a writing unit to form a recording image on a transfer sheet on the basis of the recording signal, and a selector to select a monitor mode. The apparatus further includes a controller to select the writing unit so as to form plural recording images corresponding to each of the plural γ-curves, on the transfer sheet within a single copy operation, when the monitor mode is selected.

FIG. 3



EP 0 683 598 A2

BACKGROUND OF THE INVENTION

The present invention r lates to an image forming apparatus in which a document imag is form d on a transfer sheet by the digital image forming system, and more particularly relates to an image forming apparatus capable of forming an image by setting a γ-curve.

In this case, the γ-curve shows a relation of density between the document and the copy as illustrated in Fig. 6. When this γ-curve changes, the copy image characteristics also change in accordance with the γ-curve.

Even in the conventional copier of the analog system, image density is adjusted by changing the development bias. In an image forming apparatus of the digital system, a document image is formed on a light receiving element such as CCD by an optical system. Then an electric signal obtained by photoelectric conversion is subjected to image processing. After that, the electric signal is converted into an optical signal by means of laser, and a latent image is formed on an image forming body. Consequently, in the image forming apparatus of the digital system, it is possible to correct image density using a γ-curve in the image processing section. In the copier of the digital system, a plurality of γ-curves are previously provided, and values of the γ-curves are inputted in accordance with the use. For example, predetermined values obtained from a γ-curve are inputted when the document to be copied is a newspaper, while the result can not be checked. In the same manner, predetermined values obtained from a γ-curve used for a wire-dot printer are inputted. Further, the apparatus is set in such a manner that the operator can not neglect to input the values of a γ-curve.

SUMMARY OF THE INVENTION

In the case of a copier of the digital system, when a γ-curve suitable for a document to be copied is selected, fog of the background can be reduced, so that an image of appropriate density can be provided. An object of the present invention is to provide an image forming apparatus in which the operator can select a γ curve suitable for the document in accordance with his visual judgment.

In order to accomplish the above objects, the first embodiment of the present invention comprises the following composition.

An image forming apparatus comprises: an image reading unit for optically reading a document image and for converting a read document image into an electric signal; a corr cting means for correcting the electric signal in accordance with the γ-curve so as to generate a recording signal, the correcting means having a plurality of γ-curve characteristic data corresponding to a plurality of γ-curves; a writing unit for forming a recording image in a transfer she t on the basis of th recording signal; a monitor mode sel ction means; and a control means for controlling the writing unit when a monitor mode is selected by the selection means so that a plurality of recording images corresponding to the plurality of γ-curves can be formed on the transfer sheet by one operation.

The second embodiment of the present invention is to provide an image forming apparatus according to the first embodiment, and the second embodiment further comprises: an inputting means for inputting a specific γ-curve selected from the plurality of γ-curve.

In this case, the control means controls the correcting means and the writing unit in accordance with the γ-curve characteristic data corresponding to the specific γ-curve inputted by the inputting means.

The third embodiment of the present invention is to provide an image forming apparatus according to the first embodiment, wherein the control means forms a plurality of recording images corresponding to the plurality of γ-curves in a plurality of potions on one transfer sheet in the monitor mode.

The fourth embodiment of the present invention is to provide an image forming apparatus according to the first embodiment, and the image forming apparatus further comprises an image storage unit for storing image data corresponding to the electric signal, wherein the correcting means corrects the image data sent from the image storage unit using the γ-curve so as to generate a recording signal.

The fifth embodiment of the present invention is to provide an image forming apparatus according to the second embodiment, wherein each of the plurality of γ-curves is coded with a plurality of corresponding codes, and the inputting means identifies the code and indicates the γ-curve characteristic data corresponding to the correcting means.

The sixth embodiment of the present invention is to provide an image forming apparatus according to the fifth embodiment, wherein the code is a number.

The seventh embodiment of the present invention is to provide an image forming apparatus according to the third embodiment, wherein a code showing the corresponding γ-curve is recorded together with each of the plurality of recording images.

The eighth embodiment of the present invention is to provide an image forming apparatus according to the first embodiment, and the eighth embodiment of the present invention further comprises: a storag means for storing specific γ-curve characteristic data selected from th plurality of γ-curve characteristic data; and a calling means for calling the stored γ characteristic data from the storage means.

The nineth embodiment is an image forming apparatus comprising: an imag r ading unit for optically reading a document image and converting it into an electric signal; an image storage unit for storing the electric signal sent from the image reading unit; an

SGU unit for calling data stored in th storage unit and generating a printing pattern; and a writing unit for converting an electric signal of either the imag reading unit, the image storing unit or th SGU unit into an ptical signal, th writing unit forming an electrostatic latent image on an image forming body in accordance with the optical signal. In this case, the SGU unit has a printing function for printing a document that has been read by the image reading unit on a transfer sheet using the writing unit, wherein the printed image is composed of a plurality of portions divided in accordance with a plurality of different γ-curves. In this case, when a predetermined γ-curve is inputted through a key board, image formation is carried out in accordance with a γ-curve stored in a storage for setting image density, wherein the γ-curve is called when necessary.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an arrangement view showing an example of the image forming apparatus of the present invention.

Fig. 2 is a block diagram showing a control system of the image forming apparatus of the present invention.

Fig. 3 is a flow chart used for setting a γ-curve according to the present invention.

Fig. 4(a) to 4(c) are a schematic illustration for explaining an example of the monitor output image of the present invention.

Fig. 5 is a schematic illustration for explaining the density and γ-setting section of the present invention.

Fig. 6 is a view showing the γ curve.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 is an overall arrangement view of the example of the image forming apparatus of the present invention. An automatic document feeding section 11 is arranged on an upper surface of the image forming apparatus body 10. Documents are stacked on the automatic document feeding section 11. The uppermost document is taken out from the stack of documents and conveyed onto a platen glass on which the document image is read. The automatic document feeding section 11 reverses the document, and the reversed document is automatically conveyed onto the platen glass. Alternatively, it is possible to manually put a sheet of document at an exposure position on the platen glass.

Numeral 12 is an image reading unit. In the image reading unit, a document on the platen glass is exposed to light, and the exposed document image is formed on a light receiving element such as CCD 12a by an optical system composed of a mirror and image formation lens. CCD 12a reads imag information on the document. Then image information is subjected to photoelectric conversion, and an electric image signal is outputted. Num ral 13 is an imag processing secti n. In the image processing section, the image signal outputted from the image reading unit 12 is converted into a recording signal suitable for laser recording.

Numeral 22 is an image storage unit composed of a semiconductor memory. Document image information processed in the image processing section 13 is temporarily stored. In the case of image formation, the stored image information is outputted from the image storage unit 22 to the writing unit 14 as a recording signal. The writing unit 14 is a laser optical system. In the writing unit 14, optical scanning is conducted on a rotational photoreceptor drum 15a, and a latent image is formed. An image formation processing section 15 includes: the photoreceptor drum 15a; and chargers and developing units arranged around the periphery of the photoreceptor drum. In the image formation processing section 15, the latent image is developed, so that a toner image is formed. The toner image is transferred onto a transfer sheet discharged and synchronously fed from one of the sheet feeding sections 16(a), 16(b), 16(c), 16(d). The transfer sheet onto which the toner image has already been transferred is subjected to fixing in the fixing unit 17. After that, the transfer sheet is discharged from the sheet discharge section 18 in the case of th one-sided copy mode.

In the case of the two-sided copy mode, after one side of a transfer sheet has been fixed by the fixing unit 17, it is conveyed to the two-sided copying apparatus 19. After the transfer sheet has been reversed, a toner image is transferred onto the reverse side f the transfer sheet in the image formation processing section 15, and the toner image on the reverse side is fixed by the fixing unit 17. Then the transfer she t is discharged from the sheet discharge section 18.

The image forming apparatus of the present invention is provided with an SGU unit (Signal Generating Unit) 23 for generating a printing pattern in which data previously stored in the memory such as ROM is transmitted to the writing unit 14. Therefore, an image signal sent from the image reading unit 12, image storing unit 22 or SGU unit is inputted into the writing unit 14, and an electrostatic latent image is formed on the photoreceptor drum 15a. When the image monitor mode is selected, the SGU unit 23 has a function in which γ-curves are numbered in the case where a document read by the image reading unit 12 is printed on a transf r sheet by the writing unit 14, wher in th image is printed as a monitor image divided by a plurality of different γ-curves. When an operator inputs a desired γ-curv through ten keys on the key board after he has checked on the monitor image, it is possible that the γ-curve is stored in the memory (RAM) for arbitrarily s tting the image den-

sity, and also it is possibl that image formation is carried out in accordance with a γ-curv called from th memory when necessary.

Fig. 2 is a block diagram of the apparatus f the pres nt invention. Fig. 3 is a flow chart f th present invention. When the most appropriate γ-curve for the document is selected and set, according to the flow shown in Fig. 3, an image monitor selection key 32 on the operation panel provided on the upper surface of the image forming apparatus body 10 is pressed (F1). In this way, the image monitor mode is set. The operator sets a document to be copied on the platen (F2). For example, when a large number of copies are made from an article of a newspaper older than 10 years, the newspaper older than 10 years is set on the platen. Since the newspaper is older than 10 years, the background of the newspaper becomes thin brown. Accordingly, the most appropriate γ-curve of the old newspaper is different from that of the present newspaper.

Next, the copy button 31 on the operation panel 30 is turned on (F3), and the monitor image is formed (F4). That is, when the copy button 31 is turned on, the SGU unit 23 calls up necessary information about the γ-curve from the ROM 24, and the monitor image that has been read by the image reading unit 12 is printed on one transfer sheet by the writing unit 14 in the form of an image that has been divided by a plurality of γ-curves. Figs. 4(a) to 4(c) show an example. When there are 12 types of γ-curves to be selected, 3 copies are made, wherein each copy is divided by 4 types of γ-curves. In this case, each γ-curve is numbered. The numeral is displayed on each image screen or in a portion close to the image screen. In the example shown in Figs. 4(a) to 4(c), the numerals of the γ-curves are expressed by symbols. In other words, the fine line expresses 1, the intermediate line expresses 5, and the bold line expresses 10. When these symbols are combined, a numeral is represented.

According to visual judgment of an operator, the most appropriate γ-curve is selected, and the arbitrary γ-curve is set by the ten keys 34, and then the setting condition is confirmed by the set key 33 (F5). The characteristic of the thus set γ-curve is stored in the RAM 25. In this example, the operator determines the first appropriate and second appropriate γ-curves, and the numerals of the γ-curve are inputted through the ten keys 34, and they are finally confirmed by the set key 33. In the ROM 24, the characteristics of the γ-curves 1 to 12 are stored. Then the characteristic of a γ-curve finally determined by th set keys is called out from the ROM 24. The characteristic of the γ-curve, the numeral of which has been det rmin d first, is stored in the first storage region in the RAM 25, and the characteristic of the γ-curve, the numeral of which has been determined second, is stored in the second storage region in the RAM 25. After the arbitrary γ-curves have been set, the image monitor selection key 32 is pressed again, so that th monitor mod is r leased (F6).

Fig. 5 is a view showing a density and γ-display section 36, and a d nsity and γ setting key 33 provided on the operation panel 30 of this example. As illustrated in the drawing, the density display section includes 7 steps of D(-3), D(-2), D(-1), D(N), D(+1), D(+2) and D(+3). The γ display section includes 2 steps of γ(A) and γ(B). As illustrated in the drawing, these steps are located adjacent to each other, and a lamp is turned on at a position where the density or γ-curve has been set. Concerning the density and γ setting key 33, there are provided 2 types keys. One is a (+) key, and the other is a (-) key. When the (+) key is pressed, the setting position is moved by one step to the direction of (+). Normally, the lamp of the display section of D(N) is turned on, and copy operation is carried out under the normal condition. When the (+) key is once pressed, D(+) is turned on, and a condition in which a higher density is provided can be set. In this way, the density that is higher by one step can be provided. When the (+) key is successively pressed, the lighting position is moved to D(+2) and D(+3), so that the setting section is changed. When the key is further pressed, the display section of γ(A) is turned on. When the key is furthermore pressed, the display section of γ(B) is turned on. Under the condition that the display section of γ(A) is turned on, image formation is carried out in accordance with the γ-curve characteristic stored in the first storage region of the RAM 25, wherein this γ-curve has been determined first. Under the condition that the display section of γ(B) is turned on, image formation is carried out in accordance with the γ-curve characteristic stored in the second storage region of the RAM 25, wherein this γ-curve has been determined second. Consequently, for example, the γ-curve, by which clear characters can be obtained from a copied monitor image of a newspaper older than 10 years, is visually selected and set by the operator, and this most preferable γ-curve can be easily called out from the memory. Accordingly, even when the article of a newspaper older than 10 years is copied, the density and γ setting key is pressed so that the display section of γ(A) is turned on, and then the copy button 31 is pressed. In this way, clear characters can be copied under the condition that the background colors are evaded from the copy.

In this example, with respect to the same monitor image, the γ-curves ar stored in the first and second γ-curve storage regions. The storage regions are not n cessarily limited to the two regions. With respect to th different monitor images A and B, the first γ-curve (A) and the second γ-curve (A), and the first γ-curve (B) and the second γ-curve (B) may be stored, for example, in the first to fourth storage regions so that they can be easily called out. It should be not d that

the foregoing is included in the present invention.

According to th present inv ntion, the operator is able to select the most desirabl image outputted by the monitor in accordance with his visual judgment, so that the arbitrary γ-curve is selected. Accordingly, the most preferable image can be provided in accordance with the preference of the operator. When arbitrary γ-curves are selected and set with respect to the specific documents such as newspapers which are copied frequently, the most preferable copy image can be provided in accordance with the preference of the operator.

Claims

1. An image forming apparatus comprising:
   (a) an image reading unit for optically reading a document image and for converting a read document image into an electric signal;
   (b) correcting means for correcting the electric signal through a γ-curve and for generating a recording signal, wherein said correcting means has a plurality of γ-curve characteristics data corresponding to a plurality of γ-curves;
   (c) a writing unit for forming a recording image on a transfer sheet on the basis of said recording signal;
   (d) selecting means for selecting a monitor mode; and
   (e) control means for controlling so as to form a plurality of recording images corresponding to each of said plurality of γ-curves, on said transfer sheet by said writing unit within one copy operation, when said selecting means selects the monitor mode.

2. The image forming apparatus of claim 1 further comprising inputting means for inputting a specified γ-curve from said plurality of γ-curves,
   wherein said control means controls to operate said correcting means and said writing unit on the basis of the γ-curve characteristics data corresponding to said specified γ-curve input by said inputting means.

3. The image forming apparatus of claim 1, wherein said control means controls to form said plurality of recording images corresponding to said plurality of γ-curves at a plurality of portions on a single transfer sheet, when said s lecting means selects the monitor mode.

4. The image forming apparatus of claim 1 further comprising an image storage unit for storing an image data corresponding to the electrical signal,
   wherein said correcting means corrects said image data stored in said imag storage unit through said γ-curv , and generates a recording signal.

5. The image forming apparatus of claim 2,
   wherein each of said plurality of γ-curves is coded with a plurality of corresponding codes,
   and wherein said inputting means identifies said plurality of corresponding codes, and indicates said plurality of corresponding γ-curve characteristics data to said correcting means.

6. The image forming apparatus of claim 5, wherein said plurality of corresponding codes are numbers.

7. The image forming apparatus of claim 3, wherein codes indicating γ-curves corresponding to each of said plurality of recording images are recorded together with said plurality of recording images.

8. The image forming apparatus of claim 1 further comprising:
   memory means for storing a specified γ-curve characteristics data from said plurality of γ-curve characteristics data; and
   calling means for calling said specified γ-curve characteristics data stored in said memory means.

FIG. 1

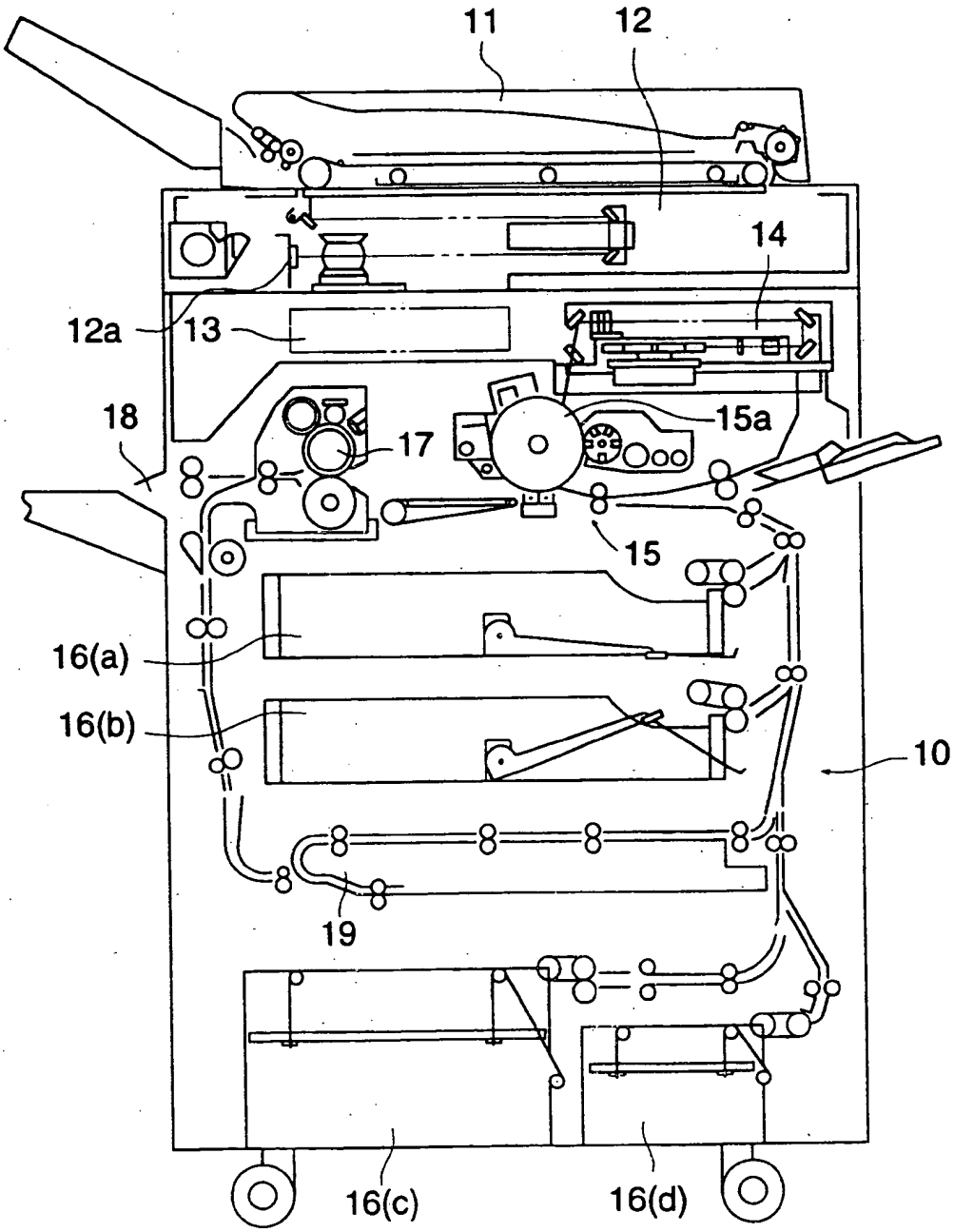


FIG. 2

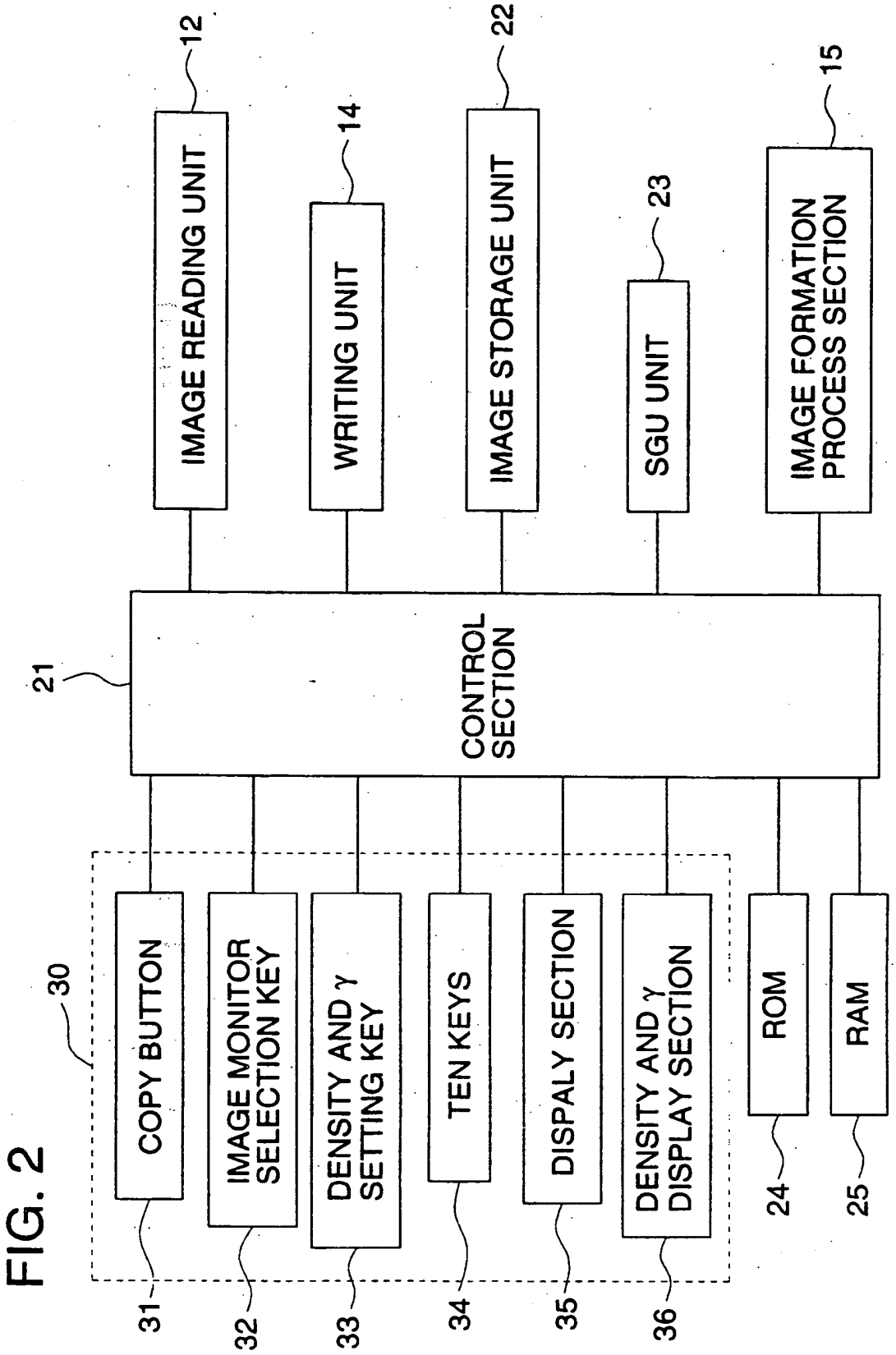

12
IMAGE READING UNIT
14
WRITING UNIT
22
IMAGE STORAGE UNIT
23
SGU UNIT
15
IMAGE FORMATION PROCESS SECTION
21
CONTROL SECTION
30
COPY BUTTON
IMAGE MONITOR SELECTION KEY
DENSITY AND γ SETTING KEY
TEN KEYS
DISPALY SECTION
DENSITY AND γ DISPLAY SECTION
ROM
RAM
31
32
33
34
35
36
24
25

FIG. 3

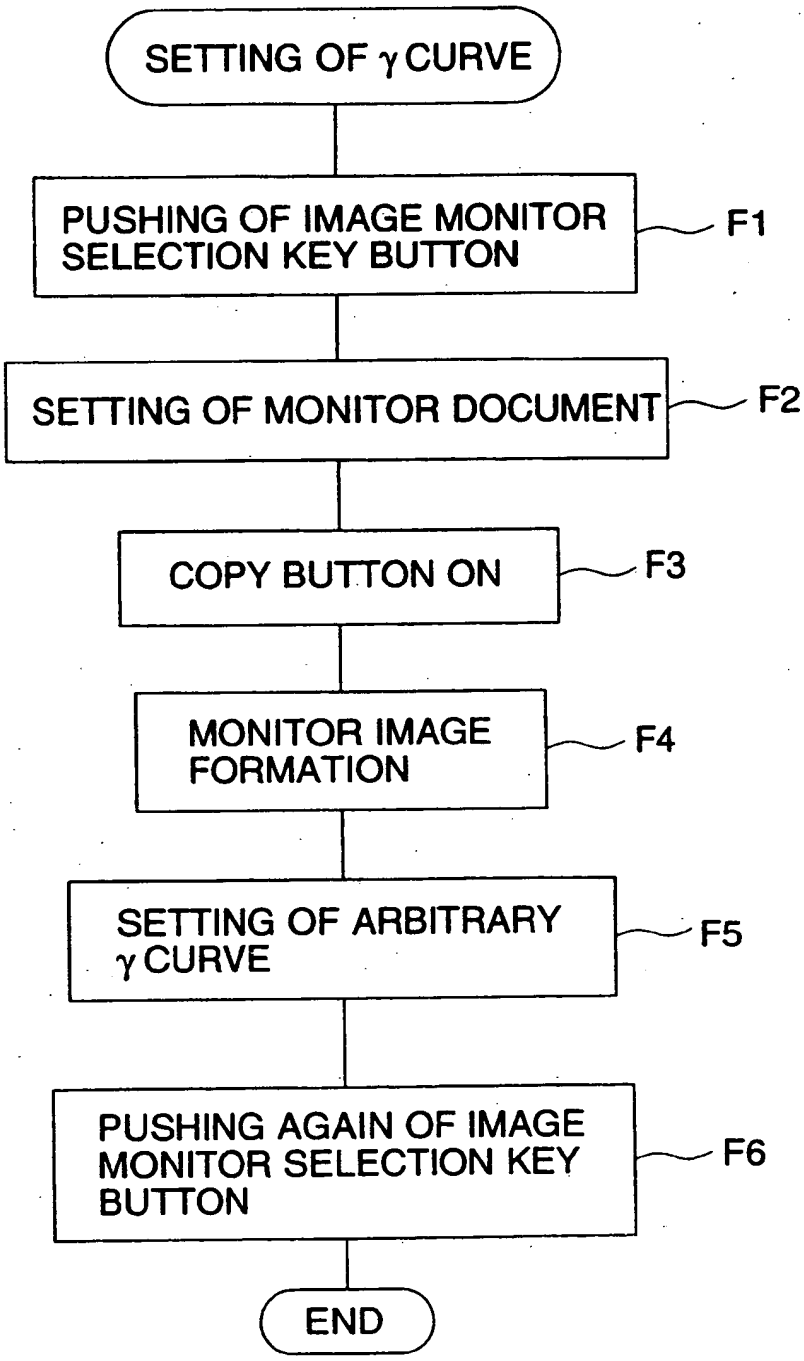

SETTING OF γ CURVE
PUSHING OF IMAGE MONITOR SELECTION KEY BUTTON
F1
SETTING OF MONITOR DOCUMENT
F2
COPY BUTTON ON
F3
MONITOR IMAGE FORMATION
F4
SETTING OF ARBITRARY γ CURVE
F5
PUSHING AGAIN OF IMAGE MONITOR SELECTION KEY BUTTON
F6
END

FIG. 4 (a)

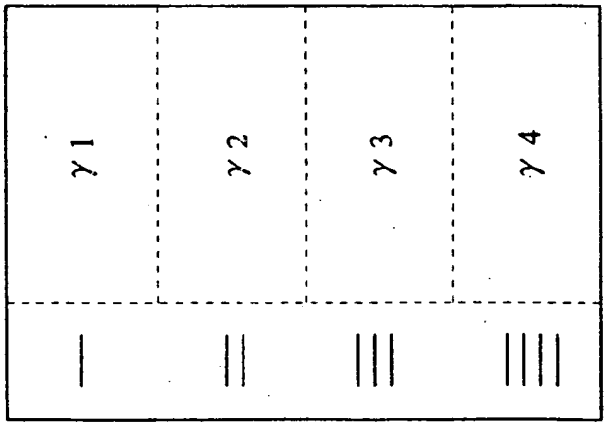


FIG. 4 (b)

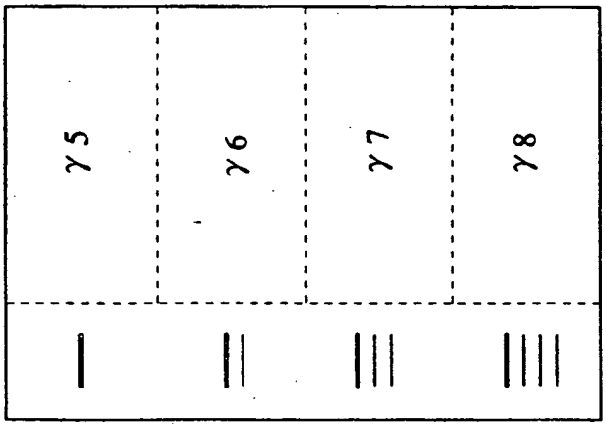


FIG. 4 (c)

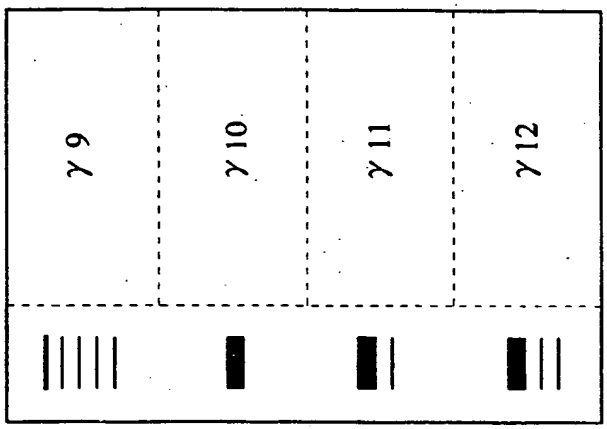


FIG. 5

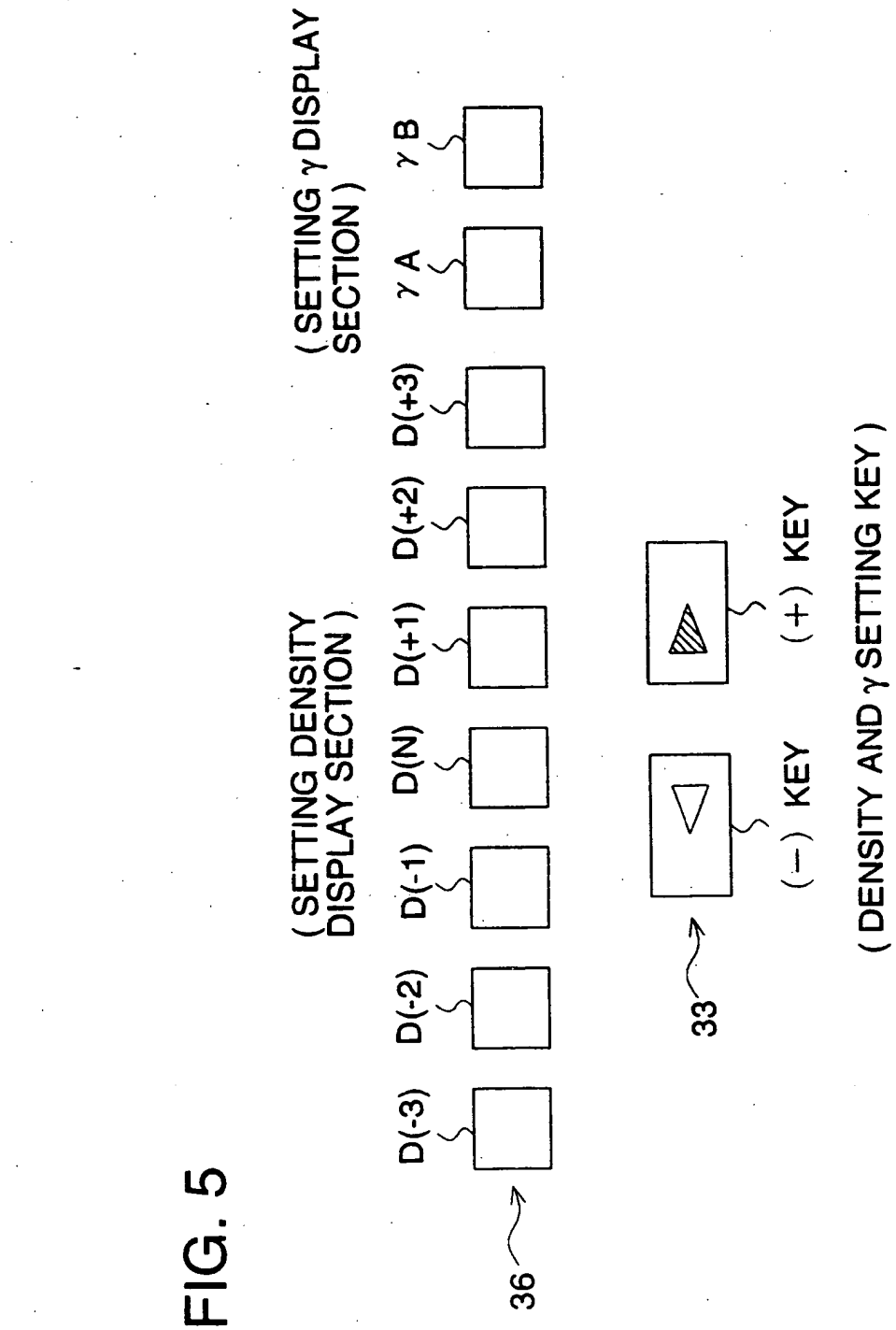
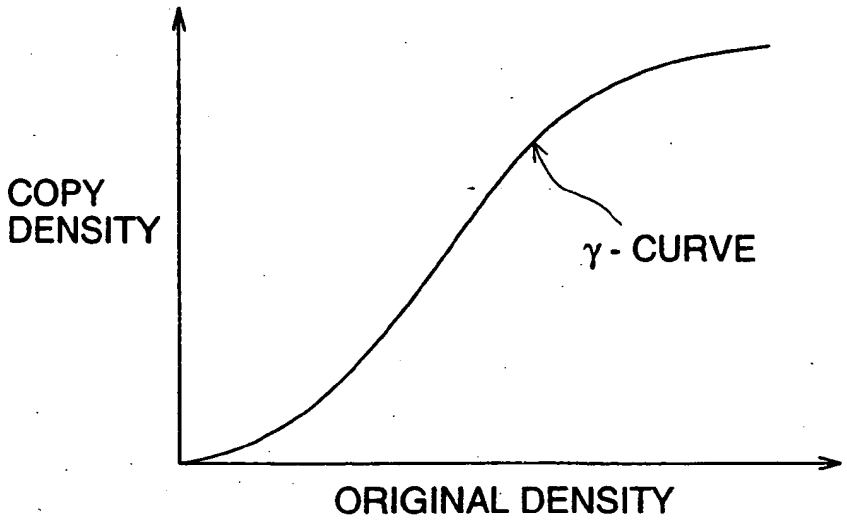

(SETTING DENSITY DISPLAY SECTION)
(SETTING γ DISPLAY SECTION)
D(-3)
D(-2)
D(-1)
D(N)
D(+1)
D(+2)
D(+3)
γ A
γ B
36
33
(−) KEY
(+) KEY
(DENSITY AND γ SETTING KEY)

FIG. 6



(19) Eur päisch s Pat ntamt
European Patent Office
Offic européen d s brevet

(11) EP 0 683 598 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
26.06.1996 Bulletin 1996/26

(43) Date of publication A2:
22.11.1995 Bulletin 1995/47

(21) Application number: **95303284.4**

(22) Date of filing: **17.05.1995**

(51) Int Cl.[6]: **H04N 1/407**

(84) Designated Contracting States:
DE FR GB IT NL

(30) Priority: **18.05.1994 JP 103978/94**

(71) Applicant: **KONICA CORPORATION**
Tokyo 160 (JP)

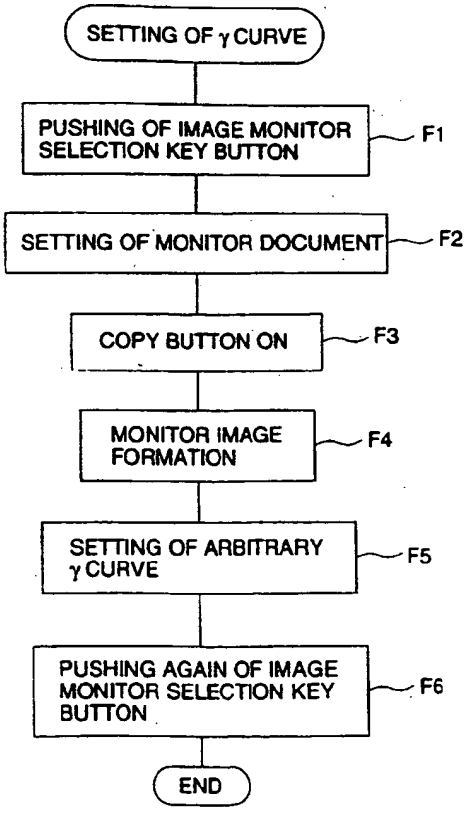
(72) Inventors:
- **Yokobori, Jun**
  Hachioji-shi, Tokyo (JP)
- **Soma, Utami**
  Hachioji-shi, Tokyo (JP)

(74) Representative: **Wood, Anthony Charles et al**
Urquhart-Dykes & Lord
91 Wimpole Street
London W1M 8AH (GB)

(54) Image forming apparatus

(57) An image forming apparatus includes an image reading unit to optically read a document image and to convert the read document image into an electrical signal, a correction member to correct the electric signal through a γ-curve and to generate a recording signal in which the corrector has plural γ-curve characteristics data corresponding to plural γ-curves, a writing unit to form a recording image on a transfer sheet on the basis of the recording signal, and a selector to select a monitor mode. The apparatus further includes a controller to select the writing unit so as to form plural recording images corresponding to each of the plural γ-curves, on the transfer sheet within a single copy operation, when the monitor mode is selected.

FIG. 3



EP 0 683 598 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 30 3284

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US-A-5 204 736 (ABE) * abstract; claim 1; figures * * column 7, line 58 - column 9, line 21 *	1-8	H04N1/407
A	US-A-4 962 421 (MURAI) * abstract; figures * * column 1, line 49 - line 57 * * column 7, line 60 - column 8, line 2 *	1-8	
A	GB-A-2 207 023 (SEIKOSHA CO LTD) * abstract; claims 1,2; figure 1 *	1	
A	EP-A-0 528 358 (MITSUBISHI) * abstract; claim 1; figures *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
H04N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 April 1996	Isa, S

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)